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ABSTRACT

The differential effects of two different types of problem-solving training on the problem-solving abilities of gifted fourth graders were studied. Two successive classes of gifted fourth graders from Weslaco Independent School District (Texas) were pretested with the Coloured Progressive Matrices (CPM) and Thinking Creatively With Pictures Figural Booklet B (TCP) to respectively determine their initial levels of ability in well-structured and ill-structured problem solving. The 1984-1985 gorup (n=45) was given problem-solving instruction using the Future Problem Solving (FPS) program. The 1985-1986 group (n=53) was given the thinking skills instruction of Instrumental Enrichment (IE) with no problem-solving structure. Standard Progressive Matrices (SPM) and the Exercise in Divergent Thinking (EDT) were used respectively as posttest measures of well-structured and ill-structured problem-solving abilities. Pretest differences noted were in favor of: the White/other group on the CPM; Hispanic females on the TCP abstractness of titles; and the FPS group on the TCP elaboration score. Significant main effects on posttest measures were noted in favor of: females on total score of the EDT; the FPS group on the EDT fluency; the FPS group on the EDT originality subscore; and, the IE group on the elaboration subscore. With effects of fluency removed from EDT originality, abstractness of titles, elaboration, and total scores, significant main effects in favor of the IE group on total score was noted and the effects of group on originality disappeared. A curriculum with activities from both programs might produce better problem solvers than either program produces alone. (Author/JAZ)

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EFFECTS OF TRAINING IN PROBLEM SOLVING ON THE PROBLEM-SOLVING ABILITIES OF GIFTED FOURTH GRADERS: A COMPARISON OF THE FUTURE PROBLEM SOLVING AND INSTRUMENTAL ENRICHMENT PROGRAMS

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Running Head: TRAINING IN PROBLEM SOLVING

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Abstract

The differential effects of two different types of problem-solving training on the problem-solving abilities of gifted fourth graders was studied. Two successive classes of gifted fourth graders from Weslaco Independent School District, were pretested with the Coloured Progressive Matrices (CPM) (Raven, 1974) and Thinking Creatively With Pictures Figural Booklet B (TCP) (Torrance, 1966) to respectively determine their initial levels of ability in well-structured and ill-structured problems solving. The 1984-1985 group (n=45) was given problem-solving instruction using the Future Problem Solving program (FPS) (Torrance, Bruch, & Torrance, 1976). The 1985-1986 group (N=53) was given the thinking skills instruction of Instrumental Enrichment (IE) (Feuerstein, 1980) with no problem-solving structure. Standard Progressive Matrices (SPM) (Raven, 1958) and the Exercise in Divergent Thinking (EDT) (Williams, 1980) were used respectively as posttest measures of well-structured and ill-structured problem-solving abilities. Pretest differences noted were in favor of: the White/other group on the CPM, $p=.02$; Hispanic females on the TCP abstractness of titles, $p=.02$; and, the FPS group on the TCP elaboration score, $p=.01$. Significant main effects on posttest measures were noted in favor of: females on total score of the EDT, $p=.04$; the FPS group on the EDT fluency, $p=.0001$; the FPS group on the EDT originality subscore, $p=.02$; and, the IE group on the elaboration subscore, $p=.0001$. With effects of fluency removed from EDT originality, abstractness of titles, elaboration, and total scores, significant main effects in favor of the IE group on total score was noted, $p=.001$, and the effects of group

on originality disappeared. Students trained in FPS were consistently more fluent while IE students consistently produced higher quality responses. A curriculum with activities from both programs might produce better problem solvers than either program produces alone.

Effects of Training in Problem Solving on the Problem-Solving Abilities of Gifted Fourth Graders: A Comparison of the Future Problem Solving and Instrumental Enrichment Programs

One of the broadly accepted goals of gifted education is to help children become independent learners (Perrone & Male, 1981; Renzulli, 1976; Torrance & Mourad, 1978; Treffinger & Barton, 1979). A characteristic used to describe independent learners is that they are efficient thinkers who are able to solve problems (Dodd & White, 1980; Gallagher, 1975; Schoenfeld, 1983; Scribner, 1984). Effective thinkers are able to gather useful information from their surroundings and deploy it for use (Schoenfeld, 1983). Further, effective thinkers have bright futures because of their ability to meet personal needs while being innovative and useful members of future societies (Naisbitt, 1982).

The delemma is that while problem solving is widely accepted as a basic skill (Dolan & Williamson, 1983; Hill, 1979; Krulik & Rudnick, 1980; Renzulli, 1976), it is seldom taught as such in schools. The usual method of teaching problem solving is to teach a particular technique or set of steps, such as for translating word problems into equations (Yeshurun, 1979), or for solving management problems (Kaufman, 1979). This has proven to be most effective in improving problem-solving performance on the kinds of problems for which the process or set of steps is specifically designed (Basadur, Graen, & Green, 1982; Berry, 1983; Houtz & Feldhusen, 1976; Scribner, 1984; Sternberg, 1983; Sweller, Mauer, & Howe, 1982; Wicker, Weinstein, Yelich & Brooks,

1978).

In General, however, transfer of specific instruction to other problem sets remains questionable (Dolan & Williamson, 1983; Treffinger, Speedie, & Brunner, 1974). For example, Treffinger et al. (1974) conducted a study that used a test of problem solving as a criterion measure and found no growth in ability to solve real-life school problems. These more real-life problems for which there may be no algorithm or set of algorithms for solution, or for which there may be a multiplicity of appropriate responses are referred to as ill-structured problems. By comparison, those problems that appear to have a clear process for testing the correctness of any proposed solution, or that have a generally agreed upon correct response are termed well-structured problems.

Most of the research directed at finding effective problem-solving instructional techniques have focused primarily on well-structured problems and have seldom considered the transfer of trained techniques to other problem structures (Sternberg, 1983). Further, most of the reported studies in problem solving have used college-age and adult subjects. The need clearly exists for research that profiles the problem-solving abilities of younger children, particularly research employing ill-structured problems (Tallent, 1985).

The present investigation undertook a comparative examination of the effects of two specific problem-solving programs on fourth grader's problem solving abilities. Both well-structured and ill-structured problems were employed in the research that focused on the potential transfer effects of these

programs. The specific research questions we addressed in this study were as follows:

1. Will gifted fourth graders who have had training in the process of Future Problem Solving score significantly different on well-structured problems from students who have been trained using the Mediated Learning Experience of the Instrumental Enrichment program?
2. Will gifted fourth graders who have had training in the process of Future Problem Solving score significantly different on ill-structured problems from students who have been trained using the Mediated Learning Experience of the Instrumental Enrichment program?

Method

Subjects

Subjects for this study were selected from the student body of the Weslaco Independent School District. The district is a large rural district serving approximately 10,000 students on single grade campuses. Between 50 and 60 percent of the student body come from families classified as migrant. The student population is about 95 percent Hispanic and five percent White with less than one percent of other ethnic backgrounds.

Subjects were fourth graders chosen for the gifted program for two consecutive school years, 1984-1985 and 1985-1986. Selection for the gifted program was determined by scores on: 1) the reading, mathematics, and language arts subtests of the Metropolitan Achievement test; 2) the Torrance Tests of Creative Thinking, either figural or verbal forms B; 3)

locally-developed criterion referenced tests of reading and mathematics achievement; 4) the Raven's Coloured Progressive Matrices; and, 5) a locally-developed behavioral rating scale. Student scores were listed on a matrix, weighted, totaled, then ranked. The top 45 students in the 1984-1985 and the top 53 of the 1985-1986 classes were chosen for the gifted program and subsequently for this study.

The proportion of males and females and the ethnic distribution of the two fourth-grade gifted groups paralleled that of the school population as a whole. Specifically, in the 1984-1985 group, there were 15 males (10 Hispanic and 5 White/Other) and 30 females (27 Hispanic and 3 White/Other). In the 1985-1986 group, there were 19 males (15 Hispanic and 4 White/Other) and 34 females (26 Hispanic and 8 White/Other).

Assessment Materials

Pretest measures. The Raven's Coloured Progressive Matrices or CPM (Raven, 1974) was used as a pretest of students' well-structured problem-solving ability. The test consists of 36 figural analogy problems presented in matrix format. These problems are arranged in three sets of twelve problems each. Within sets, items are presented in order of increasing difficulty and abstractness. The subject selects the correct response from the options provided.

The Torrance Test of Creative Thinking, Thinking Creatively with Picture (TCP), Figural Form B (Torrance, 1966) was employed as the pretest of students' ill-structured problem-solving ability. The scoring categories of fluency, originality, abstractness of titles, elaboration, and creativity index were

used in this investigation. The TCP consists of three activities: 1) Picture Construction; 2) Incomplete Figures; and, 3) Repeated Figures.

The Picture Construction activity includes an abstract, jelly-bean shape. Students are asked to produce a picture in which this abstract shape is an intregal part, to elaborate on that drawing, and to generate a title that tells a story about the picture. The completed activity is evaluated for originality on a scale of zero to five, based on the relative frequency of subject matter occurrence. That is, a very common response is rated as zero, while a rare response earns a score of five. The picture is also awarded a score for elaboration, as determined by the number of details included, and for abstractness of title. A score of zero is awarded a title that represents an obvious class, such as "man," or "egg." Three points are given a title that is abstract, appropriate, and that tells a story about the picture.

In the Incomplete Figures activity, students are asked to examine a series of ten abstract black and white figures. They are asked to complete the figures, and then to generate titles for each. A score for abstractness of titles is calculated for this activity. The Repeated Figures activity is comprised of 36 circles that the student is instructed to use in as many pictures as possible within a specified time period. The Repeated Figures activity is scored for fluency, by counting the number of responses, for originality, by the uniqueness of responses with additional points awarded for combining figures, and for

elaboration, by determining the number of details included.

Posttest measures. The Raven's Standard Progressive Matrices or SPM was used as a posttest measure of well-structured problem solving (Raven, 1958). The test is an extension of the Coloured Progressive Matrices measure used as pretest, and is designed to provide an index of intellectual capacity with little influence of culture or education. The format of the test is similar to the CPM with the deletion of the first problem set, and the addition of three progressively more abstract and complex sets of problems.

The Exercise in Divergent Thinking or EDT (Williams, 1980) was employed as a posttest measure of ill-structured problem solving. The test consists of a twelve-item timed exercise similar to the Incomplete Figures activity of the TCP. Scoring of the items on the EDT differ somewhat from the scoring of the pretest measure, the TCP.

Fluency was scored in the same manner for both the pretest and the posttest. Originality, on the EDT, was assessed on a three point scale. One point was awarded if the student drew only in the space outside a blocked area, two points were given if the individual drew only in the space inside the blocked drawing area, and three points were awarded if the child drew in areas both inside and outside the blocked area. Abstractness of title was scored as follows: Zero points were given for no title; one point for a simple title without modifier; two points for a title with a descriptive modifier; and, three points for an imaginative title expressing the picture.

Elaboration on the EDT was determined by whether the details

of the drawing provided asymmetry. That is, zero points were given if the drawing was symmetrical, two points were awarded for asymmetrical details provided inside the enclosed area, and three points were given for a response that produced asymmetry throughout the picture. Points for fluency, originality, abstractness of titles, and elaboration were each totaled across the twelve items. A total score, the sum of totals for all items across all categories, was also calculated.

Training Materials

Materials provided by the Future Problem Solving state program director were used as instructed with the fourth-grade gifted classes for 1984-1985. All suggested activities and exercises were completed, scored, and feedback given to the students in the manner prescribed by the program developers (Torrance, Torrance, & Crabbe, 1983).

Instrumentation and materials of Feuerstein's (1980) Instrumental Enrichment (IE) program were kept intact and applied as specified. Gifted fourth graders in the 1985-1986 group participated in this program. Because of the time allowance and the volume of material in the IE program, only the "Orientation of Dots" and the "Orientation in Space" units were fully completed.

Assessment Procedures

Pretesting. During November, 1983, third-grade students who had been nominated for the fourth-grade gifted program were given the TCP. Those who met the specified criteria for inclusion were placed in the gifted program and were given the CPM in September,

1984. Similarly, during November, 1984, third graders nominated for the gifted program were given the TCP. The CPM was then administered to those accepted into the program in September of the following school year.

Pretesting was done in the same manner and under similar conditions for both groups. All pretesting was carried out in large-group settings during Language Arts classes. Tests were administered by the first author in accordance with manuals directions.

Posttesting. During the next to the last Thursday of each school year, students in the 1984-1985 and 1985-1986 groups were given the EDT and the SPM. For the two groups, testing situations were controlled as to test administrator, time of day, time allotment, number of monitors, administration procedures, and general set-up of the testing area.

Scoring. Scoring of the TCP was conducted by the Scholastic Testing Service. Raw and standard scores were provided in fluency, originality, abstractness of titles, and elaboration. Standard scores were also provided which reflected students' average performance across all categories and their creativity index. The creativity index is the average score adjusted in terms of any special creative strengths not measured in the specified categories. For example, adjustments were made in average scores if students' drawings depicted movement or expressed emotions.

The CPM and SPM were hand scored, and then checked for accuracy. Raw scores were translated into percentile scores by using the table of norms provided in the manual.

The EDT was scored by three raters. Every item was scored by all raters for the categories of fluency, originality, abstractness of titles, and elaboration. When differences among raters occurred consensus was sought. When consensus was not achieved, the average of the scores was taken. Interrater reliability for scoring of the EDT was determined to be .96.

Training Procedures

Teacher training. Prior to the beginning of the 1984-1985 school year, the Social Studies teacher, who taught Future Problem Solving for the school district, attended approximately 18 hours of inservice training in Austin, Texas. This in-service focused on the steps and activities of Future Problem Solving or FPS. Topic covered in the training included how to: 1) conduct problem identification brainstorming sessions; 2) write clear and complete problem statements; 3) train students in elaboration of possible solutions; 4) use and teach ranking by criteria; 5) teach elaboration of best solutions; 6) plan the implementation of a solution; 7) select teams; and, 8) evaluate packets.

Teachers who administered the IE program met biweekly after school for one and a half hours during the 24-week training period to discuss and plan instruction for each succeeding two-week period. The first author, who spent one week receiving training in the implementation of IE processes and materials, led the discussions and prescribed the materials and methods of instruction.

Student training. Gifted students in fourth grade during the 1984-1985 school year were instructed in the FPS Program.

They were given explicit instruction in each activity and step of the FPS process. They participated fully in the program, entering the three practice contests (bowls), submitting their packets for evaluation by teachers and by state program officers. Practice bowls were held in October, December, and February. The FPS instructor found that student interest and ability to handle longer training sessions increased as the time for the bowls drew near. She increased the length of time spent on problem solving activities during these periods to take advantage of the higher levels of student motivation.

Students in the fourth grade gifted program during 1985-1986 were given approximately two hours of IE instruction per week. This instruction occurred in their Social Studies and Language Arts periods. In October and December of the school year, students participated in class-level competitions designed to allow them to use skills taught in IE. In March, all the students were assembled for the "Think Tank." The Think Tank was a district level competition in which students participated in thinking-skills and problem-solving contests. These contests were implemented to provide approximately the same kind of motivational atmosphere created by the FPS bowls. Student time in IE instruction increased as times for the contests approached to parallel the time increases in FPS. Further, awards similar to those given in FPS competition were presented for the IE contests.

Results

This investigation examined the relative effects of Future Problem Solving and Instrumental Enrichment programs on fourth

graders' ability to solve well-structured and ill-structured problems different from those directly trained. Student performance on each of these problem types prior to and following training will be discussed separately.

Well-Structured Problem Solving

Effects of the FPS and IE programs on well-structured problem-solving ability was assessed prior to and following training by means of students' performance on the CPM and SPM, respectively. Means, and standard deviations for the CPM and SPM are displayed in Table 1 by program, by gender, and by ethnicity. Mean differences on the pretest (CPM) and the posttest (SPM) were tested by two 2 (program: FPS vs. IE) x 2 (gender: male vs. female) x 2 (ethnicity: Hispanic vs. White/Other) analysis of variance procedures. Score on the CPM or SPM served as the dependent variable in each of these analyses.

Insert Table 1 about here

Coloured Progressive Matrices. Results of pretest analysis indicated that there were no significant differences in well-structured problem-solving ability prior to training for the FPS and IE groups, $F(1,90)=.32$, $p=.57$, $MSe=266.03$. There was also no significant difference between males and females on the CPM, $F(1,90)=.01$, $p=.91$, $MSe=266.03$. A significant effect for ethnicity was demonstrated, $F(1,90)=5.48$, $p=.02$, $MSe=266.03$. The White/Other group outperformed the Hispanic group on the pretest of well-structured problem-solving ability. There were no

significant interactions among program, gender, or ethnicity variables, $F<.40$, $p>.10$.

Standard Progressive Matrices. Results of the 2 x 2 x 2 analysis of variance on posttest indicated no significant main effect for program, $F(1,90)=.55$, $p=.46$, $MSe=135.92$, for gender $F(1,90)=.00$, $p=.97$, $MSe=135.92$, or for ethnicity, $F(1,90)=.93$, $p=.33$, $MSe=135.92$, on students' ability to solve well-structured problems. All interactions were nonsignificant, although the ethnicity by gender interaction approached significance, $F(1,90)=3.59$, $p=.06$, $MSe=135.92$.

A stepwise multiple regression model was employed to account for differences in R squared using the SPM posttest as dependent variable, and program, ethnicity, gender, and pretest as independent variables. The full model accounted for 26% of the total variance. With program removed as a independent variable, the model still accounted for only 26% of the variance in posttest scores. Program and ethnicity together accounted for less than 1% of the variance in SPM scores, with gender accounting for less than 2%. Removing pretest resulted in a R squared of .02. Therefore, the CPM pretest was the best predictor of posttest performance accounting for 24% of variance in SPM score. This finding is not surprising in view of the similarities in the CPM and SPM measures.

Overall, it would appear that students in the FPS or IE programs did not show marked differences in their ability to solve well-structured problems prior to training. In addition, it would seem that FPS and IE programs had little impact on students' performance of these well-structured problems, as

measured by posttest performance. Less than 1% of the total variance on the well-structured problem-solving posttest was accounted for by program, while pretest accounted for 24% of total variance on the posttest.

Ill-Structured Problem Solving

The second research question under test in this study was concerned with the effects of FPS and IE programs on students' solution of ill-structured problems different from any employed in training. Determination of effects was made by comparing students' scores for total score, fluency, originality, abstractness of titles, and for elaboration on the TCP pretest and on the EDT posttest. Means and standard deviations for program groups by test by scoring category are displayed in Table 2. A series of 2 (program: FPS vs. IE) x 2 (gender: male vs. female) x 2 (ethnicity: Hispanic vs. White/Other) analyses of variance procedures were performed to assess students' ill-structured problem-solving ability for total score and for each of the scoring categories on pretest (TCP) and posttest (EDT). Each of these tests will be discussed in turn.

Insert Table 2 about here

Thinking Creatively with Pictures. According to analysis for total scores, there were no significant main effects for either program, gender, or ethnicity on students' ability to solve ill-structured problems prior to training, $F<1.50$, $p>.20$. All interactions were also nonsignificant. Similarly, pretest

scores on the TCP demonstrated no significant main effects or significant interactions for the fluency category, $F<1$, $p>.10$, or for originality, $F<2.30$, $p>.10$. While there were no significant main effects for the abstractness of titles category, $F<2.50$, $p>.10$, there was a significant program by ethnicity by gender interaction, $F(1,90)=5.38$, $p=.02$, $MSe=326.65$. Hispanic females assigned to the FPS program produced more abstract titles on the pretest than did those assigned to the IE program. There was a significant main effect for program in the elaboration category of the TCP, $F(1,90)=6.32$, $p=.01$, $MSe=198.97$. Students in the FPS program produced significantly more elaborate responses on the pretest than did students in the IE program.

In general, it would seem that the FPS and IE groups were fairly comparable in ill-structured problem-solving ability at the outset of training, although FPS students' responses were somewhat more elaborate.

Exercise in Divergent Thinking. As with the TCP pretest, analysis on the EDT was conducted on total score, fluency, originality, abstractness, and elaboration. Results demonstrated that for total score there was a significant main effect for gender, $F(1.90)=4.45$, $p=.04$, $MSe=218.53$. Females received higher total scores on the EDT than did their male counterparts. Several significant effects emerged in the fluency category. There were significant main effects for program, $F(1,90)=17.41$, $p=.0001$, $MSe=499.36$, and for gender, $F(1,90)=4.10$, $p=.05$, $MSe=499.36$. Future Problem Solving students generated more responses on the posttest than did Instrumental Enrichment students, and females were more fluent than males. There was

also a significant ethnicity by gender interaction, $F(1,90)=5.85$, $p=.02$, $MSe=499.36$, with Hispanic females performing differentially from Hispanic males in the fluency category of the EDT. For the originality category, there was a significant main effect for program in favor of the FPS group, $F(1,90)=5.54$, $p=.02$, $MSe=304.09$. There were no significant main effects or significant interactions for the abstractness of titles category of the EDT, $F<1.50$, $p>.20$. A significant effect for program in favor of the IE group was noted in the elaboration category, $F(1,90)=25.69$, $p=.0001$, $MSe=151.81$.

A stepwise multiple regression analysis was employed to account for the relative contributions of pretest, program, gender, and ethnicity to differences in performance on the EDT posttest. Each scoring category (i.e., total score, fluency, originality, abstractness of titles, and elaboration) of the EDT was used as a dependent variable in analysis, with the corresponding categories on the TCP pretest serving as independent variables, along with program, gender, and ethnicity. R squared was calculated with the full model, with pretest removed, and then with program and pretest removed. The full model R squared for fluency was .20. Without pretest, R squared was .18, and without program the model accounted for only 3% of the total variance for fluency. Three percent of the variance on posttest was accounted for by gender and ethnicity together. In the category of fluency, program was the best predictor of posttest score.

The full model R squared for originality was .10. Without

pretest, R squared was .07. Pretest accounted for 3% of the total variance on posttest score. With program removed from the model, R squared was zero. For the category of abstractness of titles, the full model accounted for only 2% of the variance in posttest performance. All of the variance in the model was accounted for by gender, with pretest, program, and ethnicity contributing nothing. The full model R squared for elaboration was .33. Without pretest, the model still accounted for 32% of the variance in performance. Program accounted for 31% of the total variance in the elaboration category.

Quality vs. quantity of responses. Because of the more restricted range in the EDT posttest than in the TCP, students' fluency scores, the measure of quantity of production, appeared to have a significant effect on the remaining scoring categories (i.e., originality, abstractness of titles, and elaboration). In order to assess differences in quality of responses on the posttest, the effect for fluency was factored out of each of the remaining categories. This was accomplished by dividing each of the raw scores in these categories by the raw score for fluency. The means and standard deviations for each category are displayed by program in Table 3.

Insert Table 3 about here

These adjusted means were analyzed via 2 x 2 x 2 analysis of variance procedures. Analysis demonstrated no significant main effects for gender or for ethnicity on any of the scoring categories. Further, there was no significant effect for program

in the categories of originality and abstractness of titles, $F<1$, $p>.08$. These results suggest that the FPS and IE groups were comparable in their ability to produce original and abstract responses when fluency was not a factor. As in the analysis of unadjusted scores reported earlier, there was a significant effect for program in the elaboration category in favor of the IE group, $F(1,90)=96.38$, $p=.0001$, $MSe=23.02$. There was also a significant main effect for total score favoring the IE over the FPS group, $F(1,90)=30.00$, $p=.001$, $MSe=23.02$.

In summary, these findings indicate that the Instrumental Enrichment group was comparable or superior to the Future Problem Solving group on posttest performance of ill-structured problem solving when effects for fluency (quantity) were removed.

Discussion

It was the purpose of this investigation to examine the indirect effects of the Future Problem Solving and the Instrumental Enrichment programs on fourth graders' performance of well-structured and ill-structured problems. The findings of this study provide evidence of the fact that these existing programs do differentially affect students' problem-solving performance, particularly with regard to ill-structured problems. The instructional distinctiveness of these two programs rests mainly on whether they provide students a specific structure for problem solving or allow them to generate their own structure.

Future Problem Solving provides the structure and teaches skills that support the use of that structure. Instrumental Enrichment, by comparison, teaches a broad range of cognitive

skills without linking them to a particular problem-solving framework. The FPS program does not consider teaching cognitive skills directly, or by name. Neither does the FPS program consider whether the skills taught are the full range of known cognitive processing skills, but considers only whether the skills being taught will support the structure that is the mainstay of the program.

As observed, the results of this investigation indicate that there are advantages to both programs; advantages that may be differentially effective for male or female students or for students of varying ethnic backgrounds. Students trained in Future Problem Solving were consistently more fluent. Students trained with Instrumental Enrichment consistently produced better quality responses. A curriculum with activities from both programs could perhaps furnish gifted learners with more complete problem-solving skills. Developing a curriculum that includes the FPS instruction in fluency, along with the training provided by IE, for example, might produce problem solvers who would be able to more efficiently produce a number of quality responses to both well-structured and ill-structured problems. Of course, much more research is required to confirm and extend the findings of the present investigation. Considering the essential role that problem solving plays in learning, for nongifted as well as for gifted students, such research should be a priority.

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Table 1

Means and Standard Deviations for the CPM and SPM by Program, by Gender and by Ethnicity

Groups	Program: FPS M	FPS SD	Program: IE M	IE SD
CPM				
Gender				
Male (n=34)	128.27	13.78	129.37	23.10
Female (n=64)	130.80	10.62	131.41	17.77
Ethnicity				
Hispanic (n=78)	128.70	12.07	128.54	20.70
White /Other (n=20)	135.75	7.76	138.00	16.89
Total	129.96	11.67	130.68	19.65
RPM				
Gender				
Male (n=34)	119.33	14.61	121.58	11.09
Female (n=64)	125.00	9.42	122.59	12.58
Ethnicity				
Hispanic (n=78)	123.46	10.82	121.37	11.16
White /Other (n=20)	121.50	15.33	125.17	14.56
Total	122.24	11.97	121.70	10.09

Note: All means reported as standard scores.

Table 2

Means and Standard Deviations for Program Groups by Test and by Scoring Category

	Program			
	FPS		IE	
Category	M	SD	M	SD
		TCP		
Total[a]	116.13	16.51	107.98	9.82
Fluency	99.18	14.28	99.02	15.82
Originality	119.89	27.12	106.96	6.06
Abstractness	115.53	19.18	113.79	17.40
Elaboration	100.31	19.00	86.94	7.40
		EDT		
Total	94.16	10.41	94.08	.00
Fluency	134.89	15.13	115.19	28.11
Originality	110.67	16.29	101.51	6.74
Abstractness	88.33	14.06	88.68	18.64
Elaboration	87.22	10.80	103.93	43.13

[a] Creativity Index

Table 3

Means and Standard Deviations for the Quality of Responses by Scoring Category and by Program

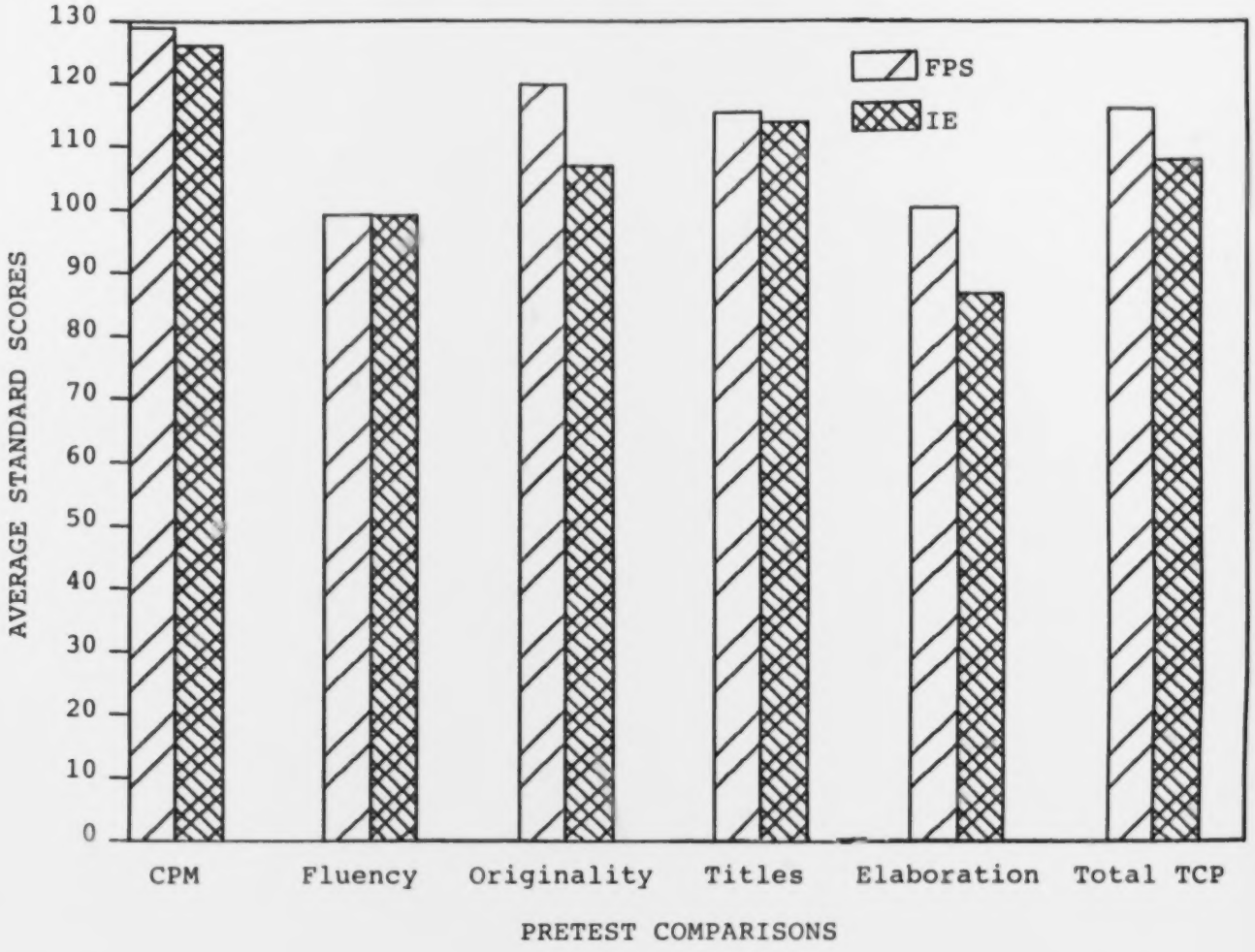
	Program			
	FPS		IE	
Category	M	SD	M	SD
Total	5.14	.64	6.19	1.02
Originality	2.88	.31	2.32	.41
Abstractness	1.84	.34	2.04	.56
Elaboration	1.01	.29	1.82	.45

Figure Captions

Figure 1. Average standard scores of Future Problem Solving and Instrumental Enrichment groups on pretest measures.

Figure 2. Average standard scores of Future Problem Solving and Instrumental Enrichment groups on posttest measures.

Figure 3. Average raw score X for Future Problem Solving and Instrumental Enrichment groups on quality measures with effects of fluency removed.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120
110
100
90
80
70
60
50
40
30
20
10
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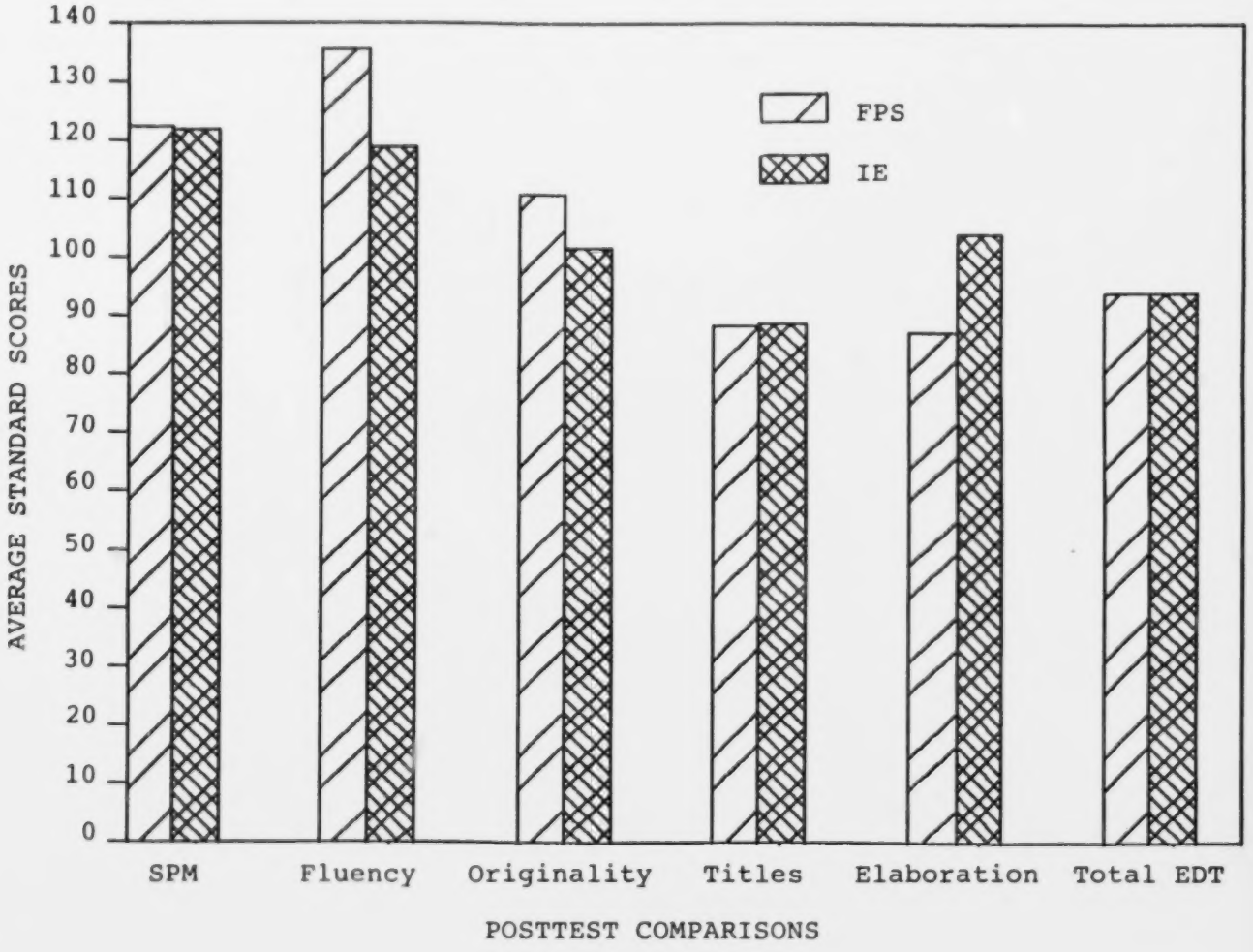
AVERAGE STANDARD SCORES
FPS
IE
CPM
Fluency
Originality
Titles
Elaboration
Total TCP
PRETEST COMPARISONS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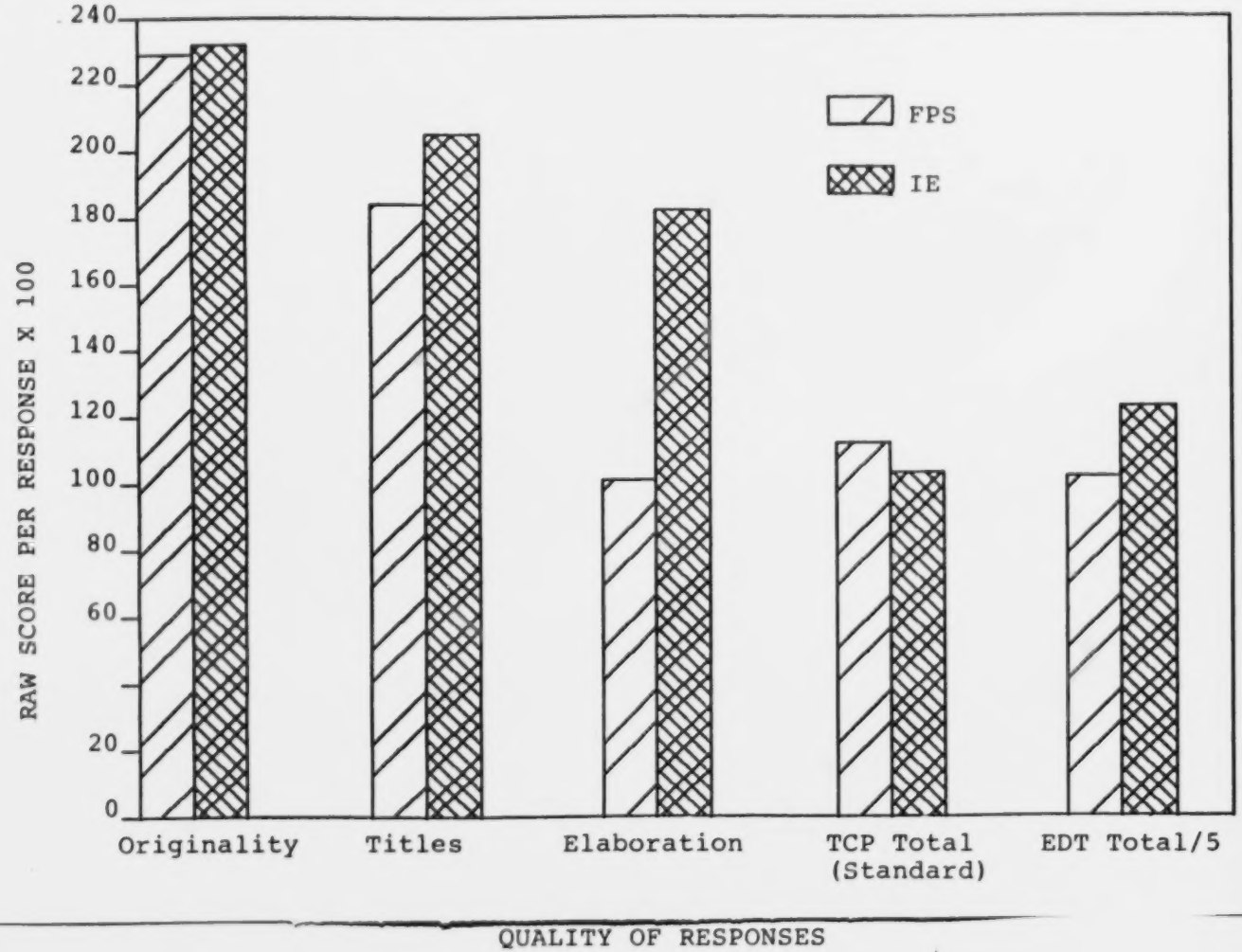
130
120
110
100
90
80
70
60
50
40
30
20
10
0
AVERAGE STANDARD SCORES
FPS
IE
SPM
Fluency
Originality
Titles
Elaboration
Total EDT
POSTTEST COMPARISONS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220
200
180
160
140
120
100
80
60
20
0
RAW SCORE PER RESPONSE X 100
FPS
IE
Originality
Titles
Elaboration
TCP Total (Standard)
EDT Total/5
QUALITY OF RESPONSES